Title:	**Natural Hazards Exposure Mapping in the United States**	
Contact(s):	Name:	Stuart Nishenko
	Agency:	FEMA
		500 C Street SW
		Washington, D.C. 20472
	Phone:	(202) 646-3945
	Fax:	(202) 646-2577
	E-mail:	stuart.nishenko@fema.gov
Hazards examined:	Earthquakes (eventually to be extended to flooding and wind events).	
Study emphasis:	Economic development, risk management and reduction as well as disaster preparedness, response and recovery strategies.	
Summary:	Offers a standardized earthquake loss estimation methodology (HAZUS) which is intended to provide local, state and regional emergency management officials with the necessary tools to plan and stimulate efforts to reduce risk from earthquakes as well as prepare for emergency response and recovery efforts following an event. A national exposure index is developed which is intended to provide a relative assessment of exposure from combined hazards and demonstrate the geographic distribution of hazard exposure for regional planning efforts.	

Natural Hazards Exposure Mapping in the United States

Stuart Nishenko, Mitigation Directorate, Federal Emergency Management Agency

In the past, much of the research on natural disasters was based on developing an understanding of the *hazard* – the location, size, and frequency of earthquakes, floods, hurricanes, tornadoes, etc. - instead of the *risk*, which is a product of the hazard, the population and building exposure, and the vulnerability. Policy, land use, and development decisions at the Federal, state, and local level are risk-based and need appropriate inputs. Areas at high risk may not always be coincident with areas of high hazard.

Detailed information about natural hazards is available for different regions of the United States through the efforts of various Federal agencies such as the Departments of Agriculture, Commerce, and Interior including the US Geological Survey, the National Weather Service, the Army Corps of Engineers, the National Flood Insurance Program, the National Science Foundation, and professional organizations such as the American Society of Civil Engineers. There are few corresponding risk maps or standardized methodologies, however, that could be used for risk-based planning and mitigation. Most of the general understanding about risk is

restricted to property damage, insured portfolio losses, and casualties related to specific scenario events or regional probabilistic loss studies (NRC, 1989; NIBS, 1994). Without such standardized technologies, it is infeasible to compare levels of damage or losses between regions of the country or between hazards.

In support of the National Mitigation Strategy, the Federal Emergency Management Agency (FEMA) has developed a standardized earthquake loss estimation methodology, HAZUS (Hazards US) that uses a nationally consistent hazard, vulnerability, and inventory database to estimate earthquake losses throughout the United States. Similar models for flood and wind loss are currently under development. HAZUS is intended to provide local, state, and regional emergency management officials with the tools necessary to plan and stimulate efforts to reduce risk from earthquakes and other natural disasters and to prepare for emergency response and recovery following the events.

The nationally consistent building inventory in HAZUS provides an ideal platform to assess and compare hazards exposure across multiple regions throughout the United States. The analysis summarized in this study consists of overlaying a series of national scale hazards maps (coastal wind, riverine and coastal flooding, and earthquake ground motions) onto the HAZUS inventory of residential and non-residential buildings and population. The economic exposure to each hazard, at some threshold value, is presented in terms of the replacement value for residential and non-residential buildings and a per capita estimate. Both the magnitude of the exposure as well as the location of that exposure are used to develop a national exposure index. This index is intended to provide a relative assessment of exposure from these combined hazards and demonstrate the geographic distribution of hazard exposure for regional planning efforts.

In this analysis, the exposure to the 100 year or 1% annual chance flood, coastal wind (>120 mph) or earthquake (>20% g) event represents approximately $3 trillion or 25% of the total replacement value for the national building stock and is comparable for each event type (i.e. exposure to wind, earthquake and flooding are each approximately $1 trillion). Geographically, however, these exposures are quite different. Hurricane wind exposure is spread along the Atlantic and Gulf coasts, flood exposure is ‘uniformly’ distributed across the nation, and earthquake exposure is primarily concentrated in the state of California. Exposure to the 500 year or 0.2% annual chance flood, wind, and earthquake events represents approximately $6.6 trillion or 50% of the building inventory replacement value and is dominated by hurricane wind events.